

MINISTRY OF EDUCATION, SINGAPORE  
in collaboration with  
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE  
General Certificate of Education Ordinary Level

---

Paper 1 Multiple Choice

October/November 2014

1 hour

Additional Materials:      Multiple Choice Answer Sheet

---

**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

**DO NOT WRITE IN ANY BARCODES.**

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

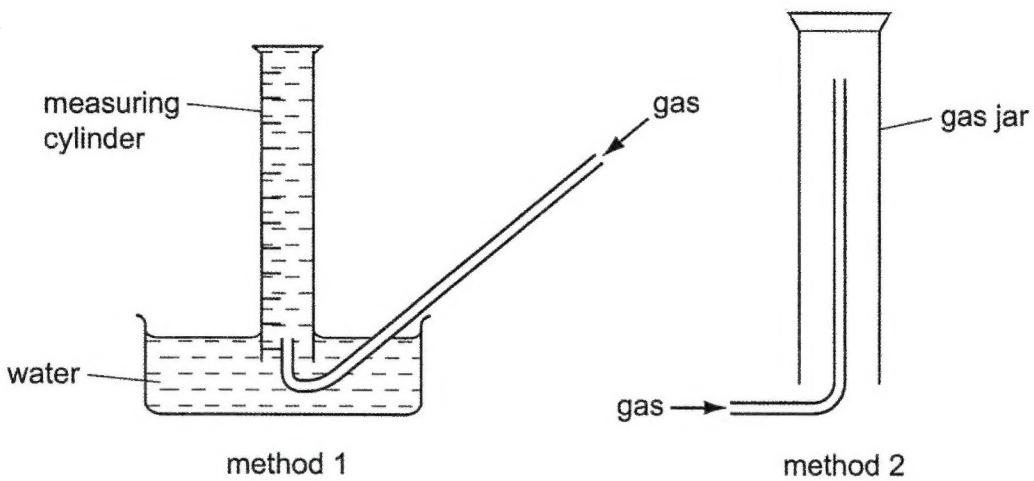
**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

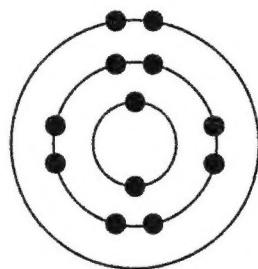
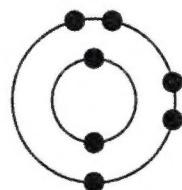
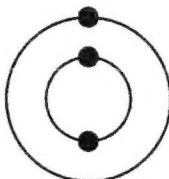
21 The diagrams show two methods of collecting gases.



Which row gives the properties of a gas which can be collected by both methods?

	property 1	property 2
A	insoluble in water	denser than air
B	insoluble in water	less dense than air
C	soluble in water	denser than air
D	soluble in water	less dense than air

22 The diagrams show the electronic structures of four elements.



Which elements are metals?

- A 1 and 2      B 1 and 3      C 2 and 4      D 3 and 4

23 The particles in substance Z are widely spaced and able to move freely.

Z changes to a state in which the particles are in contact but still able to move freely.

What is this change called?

- A condensation
- B evaporation
- C freezing
- D melting

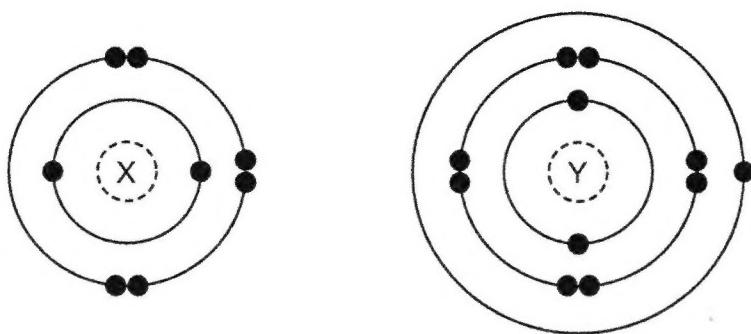
24 The nucleon number and proton number of an atom of X and an atom of Y are shown.

	X	Y
nucleon number	39	40
proton number	19	18

Which statement about X and Y is correct?

- A An atom of X has fewer electrons than an atom of Y.
- B An atom of X has fewer neutrons than an atom of Y.
- C X is above Y in the same group of the Periodic Table.
- D X is in the same period in the Periodic Table as Y.

25 The electronic structures of two atoms X and Y are shown.



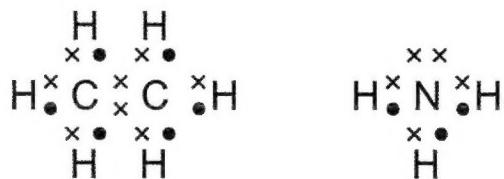
X and Y combine together to form a compound.

Which row describes the type of bonding and the formula of the compound?

	type of bonding	formula
A	covalent	$\text{Y}_2\text{X}$
B	covalent	$\text{YX}_2$
C	ionic	$\text{Y}_2\text{X}$
D	ionic	$\text{YX}_2$

26 Ethane,  $\text{C}_2\text{H}_6$ , and ammonia,  $\text{NH}_3$ , are covalent compounds.

The dot and cross diagrams of these compounds are shown.

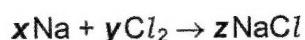


Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An uncombined nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

A 1 and 2 only    B 1 and 3 only    C 2 and 3 only    D 1, 2 and 3

27 An equation is shown.

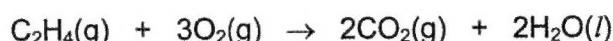


Which numbers will correctly balance this equation?

	x	y	z
A	1	1	2
B	1	2	2
C	2	1	1
D	2	1	2

28 20 cm<sup>3</sup> of ethene are reacted with 70 cm<sup>3</sup> of oxygen.

The equation for the reaction is shown.



What is the **total** volume of gas remaining at the end of the reaction?  
(all volumes are measured at r.t.p.)

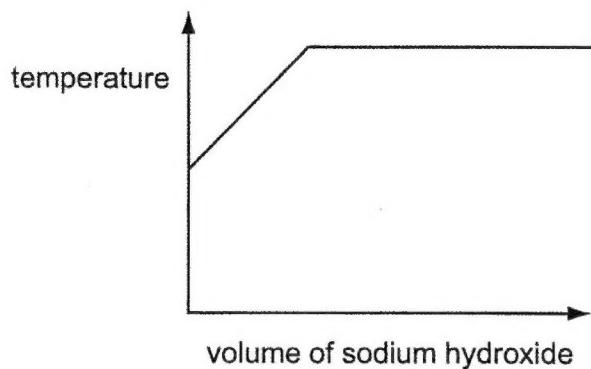
- A 40 cm<sup>3</sup>      B 50 cm<sup>3</sup>      C 80 cm<sup>3</sup>      D 90 cm<sup>3</sup>

- 29 Aqueous sodium hydroxide and dilute hydrochloric acid are reacted together. The reaction is exothermic.

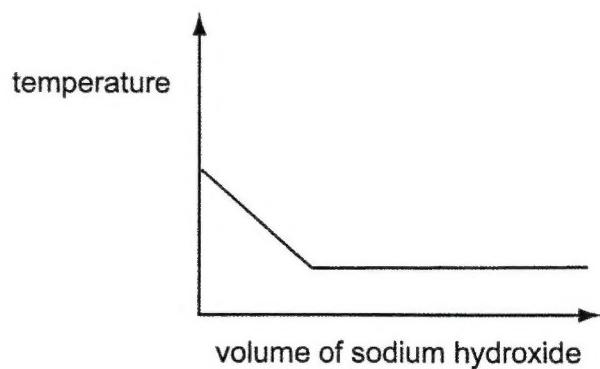
Both the sodium hydroxide and the hydrochloric acid are initially at room temperature.

Which graph shows how the temperature changes when aqueous sodium hydroxide is added to the hydrochloric acid until the alkali is present in excess?

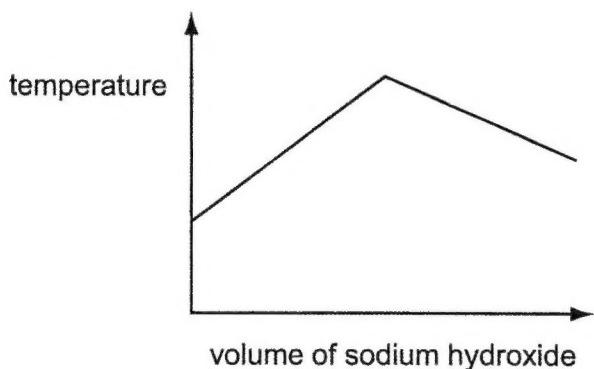
A



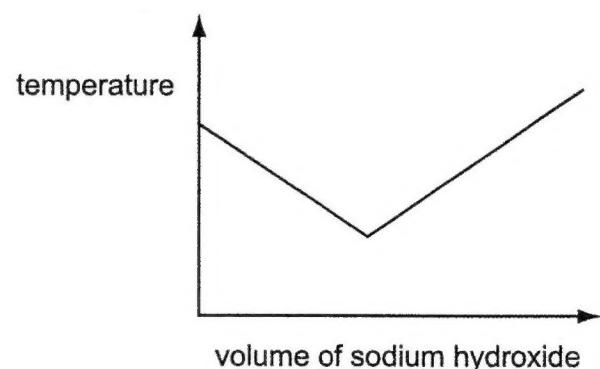
B



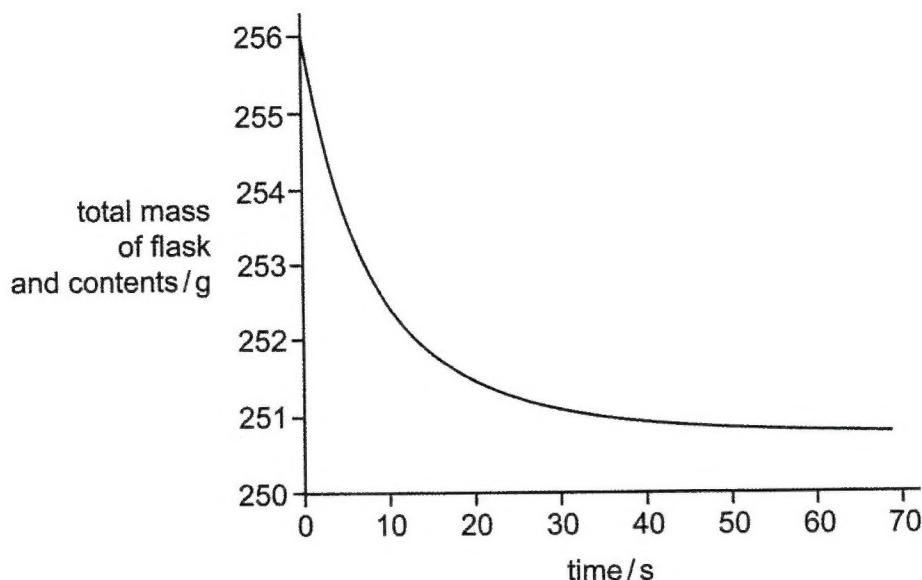
C



D



- 30 Calcium carbonate is placed in a flask on a top-pan balance and dilute hydrochloric acid is added. The total mass of the flask and its contents is recorded every ten seconds.



At which of the following times is the reaction fastest?

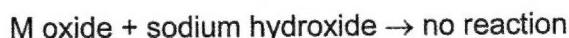
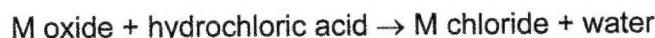
- A 10 s      B 20 s      C 40 s      D 50 s

- 31 In which reaction is the underlined substance reduced?

- A C(s) + CO<sub>2</sub>(g) → 2CO(g)  
B Cl<sub>2</sub>(g) + 2I<sup>-</sup>(aq) → I<sub>2</sub>(aq) + 2Cl<sup>-</sup>(aq)  
C Mg(s) + CuO(s) → MgO(s) + Cu(s)  
D Zn(s) + 2H<sup>+</sup>(aq) → Zn<sup>2+</sup>(aq) + H<sub>2</sub>(g)

- 32 The oxide of an element M was added separately to hydrochloric acid and aqueous sodium hydroxide.

The word equations for the reactions are shown.



Which row describes M and its oxide?

	M	M oxide
A	metal	acidic
B	metal	basic
C	non-metal	amphoteric
D	non-metal	acidic

33 What does **not** increase across a period of the Periodic Table?

- A the number of electron shells
- B the number of outer shell electrons
- C the number of protons
- D the nucleon number

34 Which row shows the properties of the element bromine?

	colour	state at room temperature	effect on potassium iodide solution
A	green	gas	turns dark brown
B	grey-black	solid	turns dark brown
C	red-brown	liquid	turns dark brown
D	red-brown	liquid	turns light red-brown

35 Metals W, X, Y and Z are placed in salt solutions as shown in the table.

metal	result of placing metal in solution of			
	salt of W	salt of X	salt of Y	salt of Z
W	no reaction	X displaced	Y displaced	no reaction
X	no reaction	no reaction	no reaction	no reaction
Y	no reaction	X displaced	no reaction	no reaction
Z	W displaced	X displaced	Y displaced	no reaction

What is the order of reactivity of the metals from most reactive to least reactive?

- A X → Y → W → Z
- B Y → W → Z → X
- C Z → W → Y → X
- D Z → Y → X → W

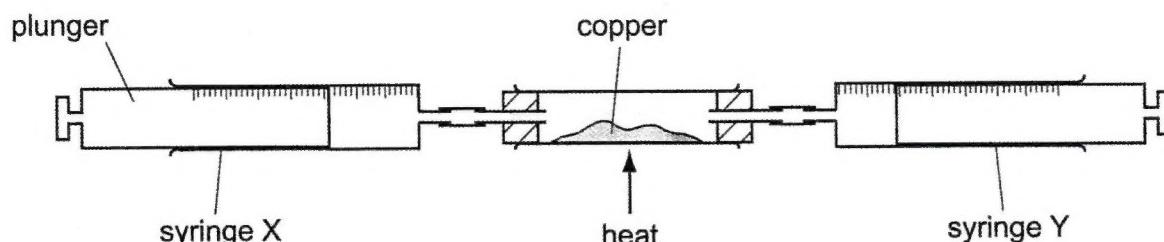
36 Which oxide is reduced to its metal by heating it in a stream of hydrogen gas?

- A aluminium oxide
- B calcium oxide
- C copper(II) oxide
- D magnesium oxide

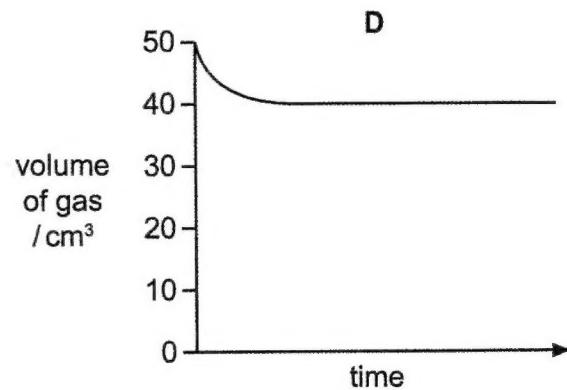
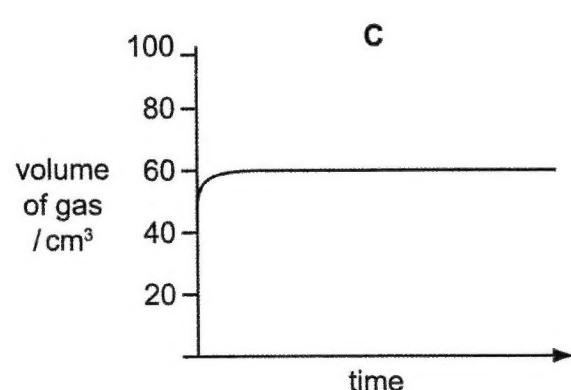
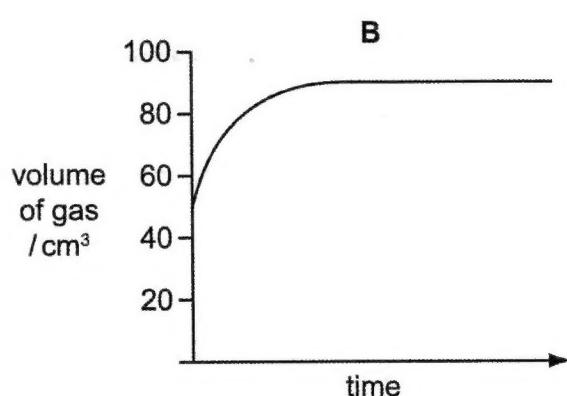
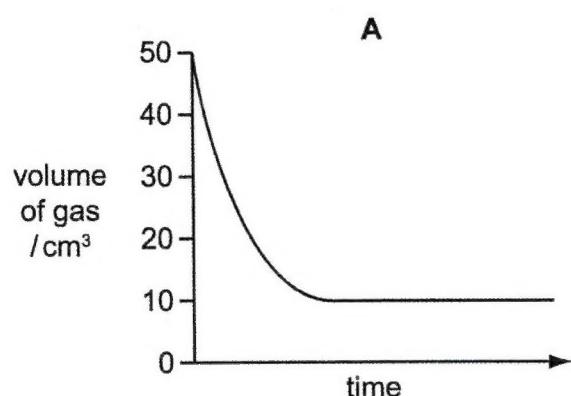
37 Heated copper reacts with oxygen to produce copper(II) oxide.

The percentage of oxygen in air can be found by passing air over heated copper. In the apparatus shown, the plungers are alternately pushed so that air passes over the hot copper.

The original volume of air was  $50.0\text{ cm}^3$ .



Which graph shows how the volume of air changes during the experiment?



**38** Petroleum is fractionally distilled to produce useful fractions.

Which row matches the fraction to its use?

	fraction	use
A	bitumen	fuel in cars
B	lubricating oils	for making waxes and polishes
C	paraffin (kerosene)	for making roads
D	petrol (gasoline)	aircraft fuel

**39** Two gases, X and Y, have the following properties.

X dissolves in aqueous sodium hydroxide but Y is insoluble

Y burns in excess oxygen to give X and water only

Y does **not** decolourise aqueous bromine

What are X and Y?

	X	Y
A	carbon monoxide	ethene
B	carbon monoxide	ethane
C	carbon dioxide	ethene
D	carbon dioxide	ethane

**40** Which compound forms ethanoic acid when it is oxidised?

- A carbon monoxide
- B ethane
- C ethanol
- D ethene

## Multiple Choice Questions

21. (B)

In method 1, the gas is passed through water and collected in the measuring cylinder. The gas has to be insoluble for displacement of water in the cylinder to occur. In method 2, the gas is collected by upward delivery. Gas that is less dense than air rises and displaces air at the top of the gas jar.

**EXAM TIP:**

Displacement of water (method 1) is used to collect gases which are not very soluble in water and upward delivery (method 2) is used to collect gases which are less dense than air.

22. (C)

Element 1 only contains one electron, indicating that it is hydrogen.

The number of valence electrons in each atom tells us the group which each element belongs to.

Element	Number of valence electrons	Group
2	1	I
3	5	V
4	2	II

Elements 2 and 4 are metals since they belong to Groups I and II respectively.

**EXAM TIP:**

Count the number of valence electrons to determine which groups the elements belong to.

23. (A)

Particles in a gas are widely spaced and can freely move around, while particles in a liquid are closely packed but can still move around each other. Substance Z changes from gas to liquid through condensation. Recall that particles in a solid are tightly packed and can only vibrate about fixed positions.

**EXAM TIP:**

The process where a substance undergoes a change from gaseous state to liquid state is called condensation.

24. (B)

From the proton numbers, X is potassium and Y is argon. Potassium has  $39 - 19 = 20$  neutrons, while argon has  $40 - 18 = 22$  neutrons, hence (B) is correct.

Recall that an atom contains an equal number of protons and electrons. Potassium has 19 electrons (i.e. electronic structure 2.8.8.1), while argon has 18 electrons (i.e. electronic structure 2.8.8). Potassium belongs to Group I and is in Period 4 while argon belongs to Group 0 and it is in Period 3.

**EXAM TIP:**

The proton number gives the number of protons in the nucleus of an atom. The number of electrons is equal to the number of protons in an atom. The nucleon number gives the total number of protons and neutrons in an atom.

41

October/November 2014

25. (C)

Since Y has one valence electron, it is a Group I metal. Thus the type of bonding formed is ionic.

To attain a noble gas electronic configuration, X gains two more electrons to form  $X^{2-}$  and Y loses one electron to form  $Y^+$ . Hence, two atoms of Y and one atom of X will combine to form  $Y_2X$ .

**EXAM TIP:**

Ionic bonds are formed by electron transfer, where metal atoms donate electrons to non-metal atoms.

26. (D)

Ethane contains 6 hydrogen atoms and ammonia contains 3 hydrogen atoms. Hence, (1) is correct.

Nitrogen is a Group V element, which contains 5 valence electrons. Hence, (2) is correct.

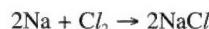
In ethane, the 2 carbon atoms form a covalent bond by sharing two electrons, one from each carbon atom. Hence, (3) is correct.

**EXAM TIP:**

Covalent bonds are formed between non-metal atoms (e.g. C, H, N atoms). Covalent bonds are formed by sharing of electrons between atoms.

27. (D)

Balance the equation by making sure that the number of atoms of each element on both sides of the equation are the same.



$$\therefore x = 2, y = 1, z = 2$$

**EXAM TIP:**

The number of atoms of each element should be the same on both sides of a chemical equation.

28. (B)

20 cm<sup>3</sup> of ethene completely reacts with 60 cm<sup>3</sup> of oxygen. There is an excess of 10 cm<sup>3</sup> of oxygen in this reaction. 40 cm<sup>3</sup> of carbon dioxide will be produced. Thus, a total of 50 cm<sup>3</sup> of gas remains at the end of the reaction.

**EXAM TIP:**

Identify the limiting reagent in the reaction to determine the volume of the excess reacting gas. The total volume of gas remaining should include the excess reacting gas and CO<sub>2</sub> produced from the reaction.

29. (C)

In an exothermic reaction, heat is released and this can be detected by an increase in temperature of the reaction mixture. After the reaction is complete, the reaction mixture cools to room temperature.

**EXAM TIP:**

Neutralisation of an acid and an alkali releases heat to the surroundings. The reaction will stop once there is an excess of alkali.

**30. (A)**

The rate of reaction is the fastest at 10 s, where the gradient of the curve is the steepest. A gentle slope indicates a low rate of reaction while a steep gradient indicates a high rate of reaction.

**EXAM TIP:**

The reaction is the fastest when the gradient of the graph is the steepest.

**31. (B)**

- (B): The oxidation state of Cl decreases from 0 in  $\text{Cl}_2$  to  $-1$  in  $\text{Cl}^-$ ,  $\therefore \text{Cl}_2$  is reduced.
- (A): The oxidation state of C increases from 0 in C to  $+2$  in  $\text{CO}$ ,  $\therefore \text{C}$  is oxidised.
- (C): The oxidation state of Mg increases from 0 in  $\text{Mg}$  to  $+2$  in  $\text{MgO}$ ,  $\therefore \text{Mg}$  is oxidised.
- (D): The oxidation state of Zn increases from 0 in  $\text{Zn}$  to  $+2$  in  $\text{Zn}^{2+}$ ,  $\therefore \text{Zn}$  is oxidised.

**EXAM TIP:**

A decrease in oxidation state of the underlined substance indicates that the underlined substance is reduced.

**32. (B)**

Since M oxide reacted only with hydrochloric acid only, it is a basic oxide. Only metals form basic oxides, therefore M is a metal.

**EXAM TIP:**

Basic oxides react with acid to form salt and water, and do not react with bases. Only metals form basic oxides.

**33. (A)**

The number of electron shells does not change across a period, but increases down a group.

**EXAM TIP:**

Across a period of the Periodic Table, there is an increase in the number of outer shell electrons, number of protons and nucleon number respectively.

**34. (C)**

Bromine is a reddish-brown liquid at room temperature. A more reactive halogen displaces a less reactive halogen from its salt. Since bromine is more reactive than iodine, the colourless iodide ions are displaced, resulting in the formation of iodine.



When dissolved, iodine forms a dark brown solution.

**35. (C)**

A less reactive metal is displaced from its salt solution when a more reactive metal is introduced. Z displaces W, X and Y from their respective salts, therefore Z is the most reactive. W is the next most reactive as it displaces X and Y from their respective salts. Y is the next most reactive as it displaces X from its salt. X is the least reactive as it does not displace any of the metals from their salts.

Order of reactivity:  $Z > W > Y > X$

**EXAM TIP:**

A more reactive metal displaces a less reactive metal from its salt solution.

**36. (C)**

Copper lies below hydrogen in the reactivity series, so its oxide can be reduced to obtain copper metal by heating with hydrogen gas. Aluminium, calcium and magnesium are found high in the reactivity series, and harsher conditions (e.g. electrolysis of the molten oxide) are required to reduce their oxides.

**EXAM TIP:**

A less reactive metal can be displaced from its compound by hydrogen.

**37. (D)**

Dry air consists of approximately 20% oxygen gas. Since only oxygen is used up in the experiment,  $40 \text{ cm}^3$  (80% of  $50 \text{ cm}^3$ ) of air remains.

**EXAM TIP:**

The volume of air remained will be less than the original volume as oxygen is used up during the reaction.

**38. (B)**

**EXAM TIP:**

Lubricating oils are used for making waxes and polishes. Bitumen is used for making road surfaces; paraffin is used as fuel for aircrafts; petrol is used as fuel for cars.

**39. (D)**

X is acidic since it reacts with sodium hydroxide (indicated by the dissolving of X),  $\therefore \text{X}$  is carbon dioxide. Y is a saturated compound since it does not decolourise aqueous bromine,  $\therefore \text{Y}$  is ethane. Ethane undergoes complete combustion when there is excess oxygen, giving carbon dioxide and water only.

**40. (C)**

Alcohols are oxidised to form carboxylic acids.

**EXAM TIP:**

Ethanoic acid can be obtained from the oxidation of ethanol.